

This summary has been prepared in response to a request for information for veterinarians treating animals that have had exposure to or consumed contaminated river water.

EPA does not have any health-based criteria specific for use in evaluating exposure of livestock or pets to contaminated surface water. Instead, we can look at values developed by states, provinces, or other agencies/organizations, and/or EPA values for wildlife and/or humans when appropriate.

For metals, the Province of Alberta has developed guidelines for environmental quality of surface waters relevant to long-term livestock ingestion (Environmental Quality Guidelines for Alberta Surface Waters; Alberta Government, 2014; <http://esrd.alberta.ca/water/education-guidelines/documents/EnvironmentalQualitySurfaceWaters-2014.pdf>).

For the protection of livestock water uses, Alberta's water quality guidelines for the metals of interest in the Animas River evaluation are as follows:

Cadmium:	80 ppb
Copper:	500 ppb (sheep)
	1,000 ppb (cattle)
	5,000 ppb (swine, poultry)
Lead:	100 ppb
Zinc:	50 ppm

Cadmium

Livestock: In one sample collected from Cement Creek, the cadmium concentration exceeded the Alberta livestock guideline for cadmium (80 ppb); all other samples fell below 80 ppb. Therefore, the likelihood of toxicity to livestock resulting from ingestion of cadmium in river water is low.

Pets: With respect to companion animals (i.e., pets), there are no specific values that establish safe levels of exposure to cadmium. Under such circumstances, it is reasonable to refer to applicable human recommendations, which are likely to be protective for pets as well. The EPA's Maximum Contaminant Level (MCL) for cadmium in drinking water is 5 ppb. Cadmium concentrations in samples collected from Cement Creek exceeded the MCL for cadmium, and cadmium concentrations in some samples collected from the Animas River temporarily exceeded the MCL for cadmium. Pets encountering concentrations of cadmium above the MCL would have been exposed for a relatively short duration of time, given that the concentrations of metals are generally declining as the plume moves downstream. Therefore, the likelihood of toxicity in pets resulting from ingestion of river water containing elevated concentrations of cadmium is low.

Cadmium toxicity: Acute cadmium toxicity primarily affects the gastrointestinal tract and kidneys. Signs may include abdominal pain, vomiting, diarrhea, anorexia, and dehydration. Elevated concentrations of cadmium in blood may be indicative of poisoning. General approaches to treatment may include symptomatic support and chelation therapy.

Copper

Livestock: Copper concentrations in some samples collected from Cement Creek and the Animas River may have temporarily exceeded the Alberta livestock guidelines, depending on the species of interest (sheep versus cattle versus swine/poultry) and location of the sample. However, since concentrations of metals are declining as the plume moves downstream, any livestock exposed to concentrations above the guideline would have been exposed for a very short duration. Thus the likelihood of toxicity resulting from ingestion of river water containing elevated concentrations of copper is low.

Pets: With respect to companion animals (i.e., pets), there are no specific guidelines that establish safe levels of exposure to copper. For humans, the EPA's Action Level for copper in drinking water is 1.3 ppm (1,300 ppb). Copper concentrations in some samples collected from Cement Creek and the Animas River may have temporarily exceeded EPA's Action Level of 1,300 ppb. However, pets encountering concentrations of copper above the Action Level would have been exposed for a very short duration of time, given that the concentrations of metals are declining as the plume moves downstream. Therefore, the likelihood of toxicity in pets resulting from ingestion of river water containing elevated concentrations of copper is low.

Copper Toxicity: Signs of acute copper toxicity may include abdominal pain, diarrhea, anorexia, dehydration, and shock. Elevated concentrations of copper in blood may be indicative of poisoning. General approaches to treatment may include symptomatic support, chelation therapy, administration of antioxidants, and/or enhancement of copper excretion.

Lead

Livestock: The concentration of lead in one sample from Cement Creek exceeded the Alberta livestock guideline of 100 ppb. Concentrations of lead in all other water samples were below 100 ppb. The likelihood of toxicity to livestock due to consumption of lead in river water is low.

Pets: Since there are no specific values that establish safe levels of exposure to lead for pets, it is reasonable to refer to EPA's MCL for lead (15 ppb). Lead concentrations in samples collected from Cement Creek exceeded the MCL for lead, and lead concentrations in some samples collected from the Animas River temporarily exceeded the MCL for lead. Pets encountering concentrations above the MCL would have been exposed for a relatively short duration of time, given that the concentrations of metals are generally declining as the plume moves downstream. Therefore, the likelihood of toxicity in pets resulting from ingestion of river water containing elevated concentrations of lead is low.

Lead Toxicity: Signs of acute lead toxicity primarily occur in the gastrointestinal tract and nervous system. Symptoms may include anorexia, vomiting, diarrhea, colic, anxiety, salivation, incoordination, muscle spasms, blindness, and convulsions. Elevated concentrations of lead in blood, as well as other hematologic abnormalities, may indicate lead poisoning. General approaches to treatment may include symptomatic support and chelation therapy.

Zinc

Livestock: Concentrations of zinc in water samples collected from Cement Creek and the Animas River did not exceed the Alberta livestock guideline of 50 ppm.

Pets: The concentration of zinc in two samples from Cement Creek exceeded EPA's guideline of 5 ppm for zinc in drinking water. EPA's guideline is what is known as a secondary standard, which means the guideline is based, not on toxic effects, but on aesthetic or cosmetic effects (indicating the relatively low toxicity of zinc). In all other samples, concentrations of zinc were below 5 ppm. Thus, the likelihood of toxicity to pets due to consumption of zinc in river water is very low.

Manganese

Livestock: There are no livestock values for manganese available, although several sources have reported on the low toxicity of manganese even at high levels in livestock feed (up to 2,000 mg of manganese per kg of dietary dry matter) (Nutrient Requirements of Small Ruminants, 2007).

Pets: There are no specific values that establish guidelines for safe levels of exposure to manganese in pets. However, it is reasonable to consider EPA's 1-day and 10-day human Health Advisory for manganese of 1 mg/L. This value is likely to be protective for pets as well. Samples collected from Cement Creek, as well as some samples collected long the Animas River, temporarily exceeded 1 mg/L. Because concentrations of metals are declining as the plume moves downstream, any pet exposed to concentrations above the guideline would have been exposed for a very short time period and the amount of water potentially ingested would be small. Thus the likelihood of toxicity resulting from ingestion of river water containing elevated concentrations of manganese is low.

Manganese Toxicity: In laboratory animal tests, acute manganese poisoning primarily affects the central nervous system, with effects such as changes in coordination and activity level. General approaches to treatment may include symptomatic support and chelation therapy.

Dermal Exposures

Animals that may have been wading or swimming in the river at the time of the blowout are not at risk for exposure to metals through their skin, because metals are not well-absorbed by the skin. Exposure to river water with pH in the range of 3.7-7.4 would be unlikely to cause significant skin irritation. (Note that the pH of vinegar is approximately 2.4). As a precautionary measure, any animal that may have had skin contact with the river water may be thoroughly rinsed off with clean water from a source other than the river, and eyes may be flushed with clean water or sterile saline.